ВикипедиЯ

The creation of the Soviet atomic bomb

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The creation of the Soviet atomic bomb (the military part of the USSR atomic project) was fundamental research , development of technologies and their practical implementation in the Soviet Union in the period from 1942 to 1950 , aimed at creating weapons of mass destruction using nuclear energy . The activities were largely stimulated in this direction by the activities of scientific institutions and the military industry of other countries, primarily Nazi Germany (the German nuclear program) and the United States (the Manhattan Project) [1] .

Content

Background of the Soviet project

Works before 1941

In 1930-1941, active work was carried out in the nuclear field.

In this decade, fundamental radiochemical research was carried out, without which a complete understanding of these problems, their development and, especially, their implementation would be unthinkable.

All-Union conferences of the USSR Academy of Sciences on nuclear physics were held , in which domestic and foreign researchers took part, working not only in the field of atomic physics, but also in other related disciplines - geochemistry , physical chemistry , inorganic chemistry , etc. [2][3]

Since the early 1920s, work has been intensively developed at the Radium Institute and the first Phystech (both in Leningrad), at the Kharkov Physicotechnical Institute , and at the Institute of Chemical Physics in Moscow.

Academician V. G. Khlopin was considered an authority in this field . Also, significant contributions were made, among many others, by the employees of the Radium Institute: G. A. Gamov , I. V. Kurchatov and L. V. Mysovsky (creators of the first cyclotron in Europe [2]), F. F. Lange (created the first Soviet project of an atomic bomb - 1940), as well as the founder of the Institute of Chemical Physics N. N. Semenov . The Soviet project was supervised by the Chairman of the Council of People's Commissars of the USSR V. M. Molotov [4] .

In 1941, research on atomic issues was classified [4] . The beginning of the Great Patriotic War largely determined that the USSR was forced to reduce the volume of nuclear research, including research into the possibility of implementing a fission chain reaction , while in Great Britain and the USA, work on this problem continued vigorously.

The role of the Radium Institute

The chronology of research conducted by the staff of the Radium Institute in Leningrad shows that work in this area was not completely curtailed, which was largely facilitated by pre-war fundamental research. As early as 1938, the first laboratory of artificial radioactive elements in the USSR was created here (headed by A. E. Polesetsky); in 1939, the works of V. G. Khlopin , L. V. Mysovsky , A. P. Zhdanov , N. A. Perfilov and other researchers on the fission of the uranium nucleus under the influence of neutrons were published; in 1940, G. N. Flerov and K. A. Petrzhak discovered the phenomenon of spontaneous fission of heavy nuclei using uranium as an example.

Under the chairmanship of V. G. Khlopin, the Uranium Commission of the USSR Academy of Sciences was formed ; in 1942, during the evacuation of the institute, A. P. Zhdanov and L. V. Mysovsky discovered a new type of nuclear fission - the complete disintegration of an atomic nucleus under the influence of multiply charged particles of cosmic rays; in 1943, V. G. Khlopin sent a letter to the State Defense Committee and the USSR Academy of Sciences, providing a justification for the mandatory participation of the Radium Institute in the "uranium project".

The Radium Institute was tasked with developing a technology for isolating eka-rhenium (Z = 93) and eka-osmium (Z = 94) from neutron-irradiated uranium; in 1945, the first Soviet preparation of plutonium in pulsed quantities was obtained using a cyclotron. Under the direction of B. S. Dzhelepov, work began on beta and gamma spectroscopy of nuclei.

The Institute was tasked with: checking and testing methods for extracting plutonium, studying the chemistry of plutonium, developing a process flow chart for extracting plutonium from irradiated uranium, and issuing process data to the plant. In 1946, the development of a technology for obtaining plutonium from irradiated uranium was completed (headed by V. G. Khlopin). The Institute, together with the designers of the State Institute of Applied Chemistry (Ya. I. Zilberman, N. K. Khovansky), issued the process part of the design assignment for Object B (the Blue Book), containing all the necessary primary data for designing a radiochemical plant.

In 1947, G. M. Tolmachev developed a radiochemical method for determining the coefficient of use of nuclear fuel in nuclear explosions. In 1948, under the leadership of the Radium Institute and on the basis of the acetate precipitation technology developed by him, the first radiochemical plant in the USSR was launched near Chelyabinsk. By 1949, the amount of plutonium necessary for testing nuclear weapons had been produced. The first development of polonium-beryllium sources as a fuse for first-generation nuclear bombs was carried out (headed by D. M. Ziv) [2] .

Work in 1941-1943

Foreign intelligence information

As early as September 1941, intelligence information began to arrive in the USSR about secret intensive research and development work being carried out in Great Britain and the USA aimed at developing methods for using atomic energy for military purposes and creating atomic bombs of enormous destructive power. One of the most important documents received by Soviet intelligence back in 1941 was the report of the British " MAUD Committee ". From the materials of this report, received through the channels of the foreign intelligence of the NKVD of the USSR from John Cairncross (agent "List" from the Cambridge Five) - assistant secretary of the Imperial War Cabinet Lord Hankey , [5] it followed that the creation of an atomic bomb was real, that it could probably be created even before the end of the war and, consequently, could influence its course [6] . It is noteworthy that the transcript of the top-secret meeting in London on September 16 ended up on the desk of the head of foreign intelligence of the USSR P. M. Fitin on September 17 [5] .

Fitin paid attention to the reports of British agents and reported this to L. Beria , who ordered that the information received be transferred for examination to the 4th special department of the NKVD, which was engaged in scientific research and development [7] . In connection with the

information received, the following tasks were set for foreign intelligence on the problem of nuclear weapons, which in operational correspondence was further called "Enormous" (translated from English - "enormous, enormous"): [8]

- to determine the circle of countries conducting practical work on the creation of atomic weapons;
- inform the Centre about the content of these works;
- to obtain scientific and technical information that could facilitate the creation of similar weapons in the USSR.

Intelligence information about work on the problem of atomic energy abroad, which was available in the USSR at the time the decision was made to resume work on uranium, was obtained both through NKVD intelligence channels and through the channels of the Main Intelligence Directorate (GRU) of the General Staff of the Red Army.

In March 1942, the NKVD foreign intelligence prepared a special message to Stalin , which stated [8] :

> In a number of capitalist countries, in connection with the work being carried out to split the atomic nucleus with the aim of obtaining a new source of energy, a study was begun of the question of using the atomic energy of uranium for military purposes...
>
> ...The English War Cabinet, taking into account the possibility of Germany successfully resolving this problem, is paying great attention to the problem of using the atomic energy of uranium for military purposes...
>
> ...Based on the importance and relevance of the problem of the practical application of uranium-235 atomic energy for military purposes, it would be advisable for the Soviet Union:
>
> 1. To work out the issue of creating a scientific advisory body under the State Defense Committee of the USSR from authoritative persons to coordinate, study and direct the work of all scientists and scientific research organizations of the USSR dealing with the issue of uranium atomic energy...

In May 1942, the GRU leadership informed the USSR Academy of Sciences about the presence of reports of work abroad on the problem of using atomic energy for military purposes and asked to report whether this problem currently had a real practical basis. The answer to this request in June 1942 was given by V. G. Khlopin , who noted that over the past year, almost no work related to solving the problem of using atomic energy had been published in scientific literature, which indicated that they were classified.

An official letter from the head of the NKVD, L. P. Beria , to I. V. Stalin with information about work on the use of atomic energy for military purposes abroad, proposals for organizing this work in the USSR and secret familiarization with NKVD materials by prominent Soviet specialists, versions of which were prepared by NKVD employees back in late 1941 - early 1942, was sent to I. V. Stalin only in October 1942, after the adoption of the State Defense Committee order on the resumption of work on uranium in the USSR.

Soviet intelligence had detailed information about the work on creating an atomic bomb in the United States , coming from specialists who understood the danger of a nuclear monopoly or sympathized with the USSR, in particular, Klaus Fuchs , Theodore Hall , Georges Koval and David Greenglass [9] .

The hunt for data on America's uranium project began on the initiative of the head of the NKVD's scientific and technical intelligence department, Leonid Kvasnikov , back in 1942, but only fully unfolded after the arrival in Washington of the famous couple of Soviet intelligence officers: Vasily Zarubin and his wife Elizaveta. It was with them that the NKVD resident in San Francisco, Grigory Kheifets , interacted, reporting that America's most prominent physicist Robert Oppenheimer and many of his colleagues had left California for an unknown location, where they would be creating some kind of superweapon.

Lieutenant Colonel Semyon Semyonov (pseudonym "Twain"), who had been working in the United States since 1938 and had assembled a large and active intelligence group there, was tasked with rechecking the data from "Charon" (that was Heifetz's code name). It was "Twain" who confirmed the reality of the work on creating an atomic bomb, named the code for the Manhattan Project and the location of its main scientific center - the former Los Alamos colony for juvenile delinquents in New Mexico . Semyonov also provided the names of some of the scientists who worked there, who had been invited to the USSR to participate in Stalin's large construction projects and who, upon returning to the United States, did not lose their ties with extreme left organizations.

The main leaders of the Manhattan Project were identified by Elizaveta Zarubina (agent code name “Vardo”).

Pavel Sudoplatov in his book " *Special Operations. Lubyanka and the Kremlin 1930-1950* " gave the following description of it:

> Liza Zarubina was an outstanding personality. Charming and sociable, she easily established friendly connections in the widest circles. An elegant woman of classical beauty, a refined nature, she attracted people to herself like a magnet, not only men, but also women. Liza was one of the most highly skilled recruiters of agents. She spoke English, German, French and Romanian perfectly, understood Spanish and Italian. Liza looked like a typical representative of Central Europe, although she was a Romanian Jew. She could change her appearance and behavior beyond recognition.
>
> It was Vardo that managed to make, perhaps, the decisive contribution to obtaining accurate and prompt information about the progress of work in Los Alamos and technical data on the design of atomic bombs. Its main merit was the introduction into the Manhattan Project's think tank of an outstanding physicist recruited by Soviet military intelligence, Klaus Fuchs , who was transferred to the Zarubin couple as a contact.
>
> After her arrival in the United States, Lisa became friends with Albert Einstein's mistress, the wife of the famous Russian sculptor Konenkov, Margarita , who, in her simplicity of heart, told Lisa that Einstein was visiting the main figures of the Manhattan Project: Robert Oppenheimer , Enrico Fermi , Leo Szilard and others. Under pressure from "Vardo", Margarita introduced her and the residency employee Pastelnyak to Oppenheimer and his wife Katherine.

> Having become part of the family of the project's scientific director, the Soviet intelligence agents persuaded him to secure the transfer of Klaus Fuchs to Los Alamos, who became the main source of scientifically verified information for Moscow. But in addition, Lisa became close with another leading scientist in the atomic project, Szilard, and convinced him to allow several recruited specialists into the project, including Morton Sobell, Theodore Hall , and David Greenglass . The latter began working as a mechanic in the Los Alamos laboratory. Another very important agent was the Italian émigré, physicist Bruno Pontecorvo .

In this way, Soviet agents were introduced into the scientific and design centers of America, where nuclear weapons were being created. However, at the very height of establishing the intelligence operations, Liza and Vasily Zarubin were urgently recalled to Moscow. They were at a loss, because not a single failure had occurred. It turned out that the Center had received a denunciation from a residency employee, Mironov, accusing the Zarubins of treason. And for almost six months, Moscow counterintelligence checked these accusations. They were not confirmed, nevertheless, the Zarubins were no longer allowed to leave the country.

Meanwhile, the work of the embedded agents had already yielded the first results - reports began to arrive, and they had to be sent to Moscow immediately. This work was assigned to a group of special couriers. The most efficient and fearless were the spouses Maurice and Lona Cohen. After Maurice was drafted into the American army, Lona began to independently deliver information materials from the state of New Mexico to New York. To do this, she went to the small town of Albuquerque , where she visited a tuberculosis dispensary for the sake of appearances. There she met with agents with the agent nicknames "Mlad" and "Ernst".

According to the recollections of P. Sudoplatov , **12 days after the completion of the assembly of the first atomic bomb in the USA, a description of its structure had already been received in Moscow.**

In 1945, the same place received detailed documents on the characteristics of the test explosion on Mount Alamogordo , on the methods of arming the atomic bomb, as well as a report on the electromagnetic method of separating uranium isotopes.

Almost all of the project's materials were transmitted in encrypted form by radio. But although the American radio interception service recorded their texts regularly, its direction finders could not detect the location of the spy radios, and the codebreakers could not reveal the contents of the radiograms. This was only possible several years later, after the Venona project was implemented , when the intercepted texts were decoded with the help of new powerful computers.

Pavel Sudoplatov, head of Group "S", created by the NKVD in 1944 to coordinate intelligence work in the field of atomic research, wrote in the book " *Special Operations. Lubyanka and the Kremlin 1930-1950":*

> *The quality and volume of information we received from sources in Great Britain, Canada and the USA were extremely important for the organization and development of the Soviet atomic program. Detailed reports on the design and operation of the first atomic reactors and gas centrifuges, on the specifics of*

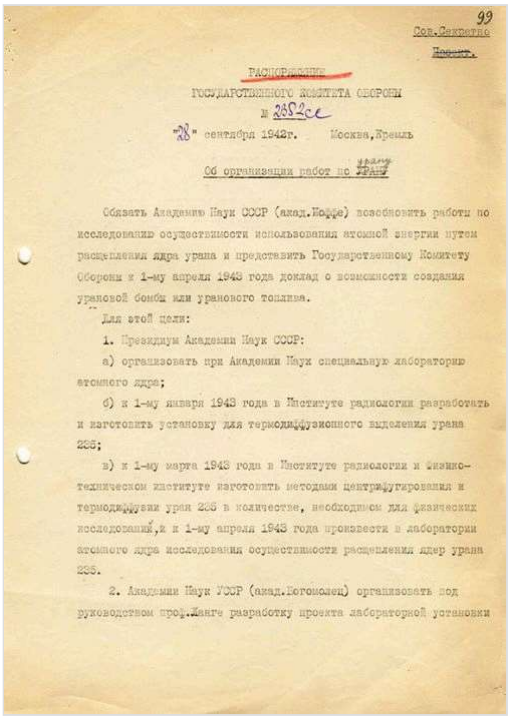
> *manufacturing uranium and plutonium bombs played a vital role in the formation and acceleration of the work of our atomic scientists, because they simply did not know a whole series of questions.*

> *This primarily concerns the design of the focusing explosive lens system, the size of the critical mass of uranium and plutonium, the implosion principle formulated by Klaus Fuchs, the design of the detonation system, the time and sequence of operations during the assembly of the bomb itself, and the method of actuating its initiator. The atomic bomb was created in the USSR in 4 years. If it were not for the intelligence officers, this period would have been twice as long.*

In 1953, the Rosenberg couple were executed in the United States for passing secret information (including information about the atomic project) to the USSR .

Launch of the atomic project

On September 28, 1942, one and a half months after the start of the Manhattan Project , State Defense Committee Resolution No. 2352ss “On the organization of work on uranium” was adopted .



State Defense Committee Resolution No. 2352ss “On the organization of work on uranium”.

It prescribed :

> To oblige the USSR Academy of Sciences (Academician Ioffe) to resume work on research into the feasibility of using atomic energy by splitting the uranium nucleus and to submit to the State Defense Committee by April 1, 1943, a report on the possibility of creating a uranium bomb or uranium fuel...

The order provided for the organization of a special laboratory of the atomic nucleus at the USSR Academy of Sciences for this purpose, the creation of laboratory installations for the separation of uranium isotopes and the implementation of a range of experimental work. The order obliged the Council of People's Commissars of the Tatar ASSR to provide the USSR Academy of Sciences in Kazan with a 500 m² room for the placement of the atomic nucleus laboratory and living space for 10 scientific staff.

Some believe that the letter addressed to Stalin in April 1942 by the Soviet physicist G. Flerov was of decisive importance, as he managed to explain the essence of the problem in a popular way. [10] On the other hand, there is reason to believe that G. N. Flerov’s work on the letter to Stalin was not completed and it was not sent. [11]

Work on the creation of an atomic bomb

On February 11, 1943, the State Defense Committee adopted Resolution No. 2872ss on the commencement of practical work on the creation of an atomic bomb. Scientific management of all work was entrusted to I. V. Kurchatov, and the Deputy Chairman of the Council of People's Commissars of the USSR and simultaneously the People's Commissar of the Chemical Industry M. G. Pervukhin was charged with the duty of daily monitoring of this work and providing comprehensive assistance. In addition, I. V. Kurchatov, together with others, was given the task of preparing a report on the possibility and timing of creating an atomic bomb. Information received through intelligence channels facilitated and accelerated the work of Soviet scientists.

On April 12, 1943, the Vice President of the USSR Academy of Sciences, Academician A. A. Baikov, signed an order to create Laboratory No. 2 of the USSR Academy of Sciences . Kurchatov was appointed Head of the Laboratory [12] .

The State Defense Committee Resolution of April 8, 1944, No. 5582ss, obliged the People's Commissariat of the Chemical Industry (M. G. Pervukhina) to design a workshop for the production of heavy water and a plant for the production of uranium hexafluoride (raw material for uranium isotope separation plants) in 1944, and the People's Commissariat of Non-Ferrous Metallurgy (P. F. Lomako) to ensure the production of 500 kg of metallic uranium at a pilot plant in 1944, to build a workshop for the production of metallic uranium by January 1, 1945, and to supply Laboratory No. 2 with tens of tons of high-quality graphite blocks in 1944.

After the defeat of Nazi Germany

After the occupation of Germany, a special group was created in the United States, the purpose of which was to prevent the USSR from capturing any data on the German atomic project [13] . It also captured German specialists who were of no use to the United States, which already had its own bomb. On April 15, 1945, an American technical commission organized the removal of uranium raw materials from Stassfurt , and within 5-6 days all the uranium was removed along with the documentation related to it; the Americans also completely removed the equipment from the mine in Saxony , where uranium was mined. Later, this mine was restored, and the Wismut enterprise was organized for the extraction of uranium ore in Thuringia and Saxony , where Soviet specialists and German miners worked .

However, the NKVD still managed to obtain several tons of low-enriched uranium at the Kaiser Wilhelm Institute [14] .

On July 24, 1945, in Potsdam, US President Truman informed Stalin that the US "now had weapons of extraordinary destructive power." According to Churchill's memoirs , Stalin smiled but did not ask for details, from which Churchill concluded that he did not understand anything and was not aware of the events. Some modern researchers believe that this was blackmail [15] . That same evening, Stalin instructed Molotov to negotiate with Kurchatov about accelerating work on the atomic project.

After the atomic bombings of Hiroshima and Nagasaki

Potsdam Conference

On August 6, 1945, the US Air Force dropped an atomic bomb on the Japanese city of Hiroshima , and on August 9, on Nagasaki . These events radically changed the political and military situation in the world, and from that moment on, the allocation of material and human resources to the creation of atomic weapons in the USSR acquired a scale that many times exceeded all previous expenditures on this topic.

Creation of a Special Committee

Fourteen days after the atomic bombing of Hiroshima, by Resolution No. 9887ss/op of the State Defense Committee of August 20, 1945, signed by I. V. Stalin, a Special Committee was formed under the State Defense Committee to direct all work on the use of atomic energy. The committee consisted of: L. P. Beria (chairman), G. M. Malenkov , N. A. Voznesensky, B. L. Vannikov, A. P. Zavenyagin, I. V. Kurchatov, P. L. Kapitsa, V. A. Makhnev, and M. G. Pervukhin. The Special Committee was granted extraordinary powers to attract any resources available to the USSR government to work on the atomic project.

The First Main Directorate under the Council of People's Commissars of the USSR (PGU) was created for the direct management of research, design, engineering organizations and industrial enterprises involved in the atomic project , subordinate to the Special Committee under the State Defense Committee. People's Commissar of Armaments B. L. Vannikov was appointed head of the PGU . Numerous enterprises and institutions from other departments were transferred to the PGU's disposal, including the scientific and technical department of intelligence, the Main Directorate of Industrial Construction Camps of the NKVD (GULPS) and the Main Directorate of Mining and Metallurgical Enterprises Camps of the NKVD (GULGMP) (with a total of 293 thousand prisoners). Stalin's directive obliged the PGU to ensure the creation of atomic bombs, uranium and plutonium, in 1948 [13] .

On September 28, 1945, the Resolution of the Council of People's Commissars of the USSR "On the additional involvement of scientific institutions, individual scientists and other specialists in work on the use of intra-atomic energy" was adopted.

The appendix to the document included a list of institutions involved in the atomic project (No. 10 included the Physicotechnical Institute of the Ukrainian Academy of Sciences and its director K. D. Sinelnikov) [16] .

Project objectives

The primary tasks were to organize industrial production of plutonium-239 and uranium-235 . To solve the first task, it was necessary to create an experimental and then an industrial nuclear reactor, and to build radiochemical and special metallurgical shops. To solve the second task, construction of a plant for separating uranium isotopes using the diffusion method was launched .

The solution of these problems became possible as a result of the creation of industrial technologies, the organization of production and the development of the necessary large quantities of pure metallic uranium, uranium oxide, uranium hexafluoride , other uranium compounds, high-purity graphite and a number of other special materials, the creation of a complex of new industrial units and devices. The insufficient volume of uranium ore mining and the production of uranium concentrates in the USSR (the first plant for the production of uranium concentrate - " Plant No. 6 of the NKVD of the USSR " in Tajikistan was founded in 1945) during this period was compensated for by captured raw materials and products of uranium enterprises in Eastern European countries, with which the USSR concluded the relevant agreements.

Creation of industry

In 1945, the Government of the USSR made the following important decisions:

- on the creation, on the basis of the Kirov Plant (Leningrad), of two special experimental design bureaus intended for the development of equipment for producing uranium enriched in the isotope 235 using the gaseous diffusion method;
- on the start of construction in the Middle Urals (near the village of Verkh-Neyvinsky) of a diffusion plant for obtaining enriched uranium-235;
- on the organization of a laboratory for work on the creation of heavy-water reactors using natural uranium;
- on the selection of a site and the start of construction in the Southern Urals of the country's first plutonium-239 production facility.

The enterprise in the Southern Urals was to include:

- uranium-graphite reactor on natural uranium (plant "A");
- radiochemical production for the extraction of plutonium-239 from natural uranium irradiated in a reactor (Plant B);
- chemical and metallurgical production for obtaining highly pure metallic plutonium (plant "V").

Nuclear facilities of the USSR in the 1950s

Participation of German specialists in the atomic project

On May 2, 1945, a group of Soviet physicists (Kikoin , Artsimovich , Khariton and several others) went to Germany to learn about the Germans' achievements in creating an atomic bomb. Soviet scientists held meetings with leading German colleagues who had not left for the West but stayed. It turned out that the Germans were far from solving this problem and their design developments would not yield anything useful [17] .

In 1945, in prisoner-of-war camps in the liberated territories of Poland and Germany, they deliberately sought out specialists related to the nuclear problem, who were immediately delivered to the USSR [5] . Most of the German scientists (about 300 people) were brought to Sukhumi and secretly placed in the former estates of Grand Duke Alexander Mikhailovich and millionaire Smetsky (the Sinop and Agudzery sanatoriums). Equipment from the German Institute of Chemistry and Metallurgy, the Kaiser Wilhelm Institute for Physics , the Siemens electrical engineering laboratories, and the Physics Institute of the German Ministry of Posts was taken to the USSR. Three of the four German cyclotrons , powerful magnets, electron microscopes, oscilloscopes, high-voltage transformers, and ultra-precise instruments were brought to the USSR. In November 1945, the Directorate of Special Institutes (9th Directorate of the NKVD USSR) was created as part of the NKVD of the USSR to manage the work on the use of German specialists .

The Sinop sanatorium was called "Object A" and was headed by Baron Manfred von Ardenne . "Agudzery" became "Object G" and was headed by Gustav Hertz . Outstanding scientists worked at Objects A and G: Nikolaus Riehl [18] , Max Volmer , who built the first heavy water production plant in the USSR , Peter Thyssen , the designer of nickel filters for gas-diffusion separation of uranium isotopes , Max Steenbeck and Gernot Zippe , who worked on the centrifuge separation method and subsequently received patents for gas centrifuges in the West. The Sukhumi Physics and Technology Institute (SPTI) was later created on the basis of Objects A and G .

Some leading German specialists were awarded government awards of the USSR for this work, including the Stalin Prize .

During the period 1954-1959, German specialists moved to the GDR at different times (Gernot Zippe to Austria) .

German uranium raw materials

During a visit by a group of Soviet physicists to Germany in May 1945, they turned their attention to another aspect of the issue: uranium raw materials, which were known to have been seized by the Germans during the occupation of Belgium (they had brought them from the South African colony). One of the Germans reported that a single organization, Rohstoffgesellschaft, located near Hitler's residence on the banks of the Spree , was in charge of meticulously registering everything confiscated or brought to Germany from all over the world. The seven-story building was filled with index cabinets with registration cards, among which Khariton and Kikoin found a card for "Uranium." Only a small portion of the raw materials were found where they were supposed to be stored, and the rest had been transported to another location. People from the NKVD , led by A. P. Zavenyagin , joined the search . As a result, about 130 tons of yellow uranium oxide were discovered at one of the plants, which local workers mistook for paint and used to repair buildings [17] .

This raw material was used to produce the first Soviet atomic bomb: the country did not have its own uranium at that time, and exploration of deposits had only just begun. “The delivery of uranium from Germany allowed us to save at least a year of work and bring the creation of our bomb closer by that time. Later, uranium deposits were found in the USSR, but they were located high in the mountains, there were no roads, and this uranium had to be brought in packs on donkeys,” noted Academician Yu. B. Khariton [17] .

Construction of factories

For the creation of the nuclear industry, the Soviet leadership chose the Urals, since this region met a number of important conditions [19] .

1. Remoteness from the country's borders and the presence of large uninhabited territories where secret objects could be hidden and which at the same time were located far from large settlements, which protected the masses of the population in case of man-made accidents.
2. Availability of developed infrastructure and transport network for delivery of large quantities of cargo.
3. Availability of war-tested, qualified personnel capable of working in extreme conditions and performing the most complex engineering and technical tasks.
4. Availability of fresh water reserves.
5. Fuel and energy resources to supply the facilities under construction with energy in the required volume.

The first nuclear facilities were plants No. 813 and No. 817, which were to receive nuclear fuel of two different modifications: the first was to produce 100 g of uranium-235 per day using the gaseous diffusion method , the second 100 g of plutonium-239 using the uranium irradiation method in a nuclear reactor [19] . When searching for construction sites, the attention of the government commission under the leadership of Professor I.K. Kikoin was drawn to finding mothballed industrial facilities that had already been started, in order to reduce the construction time of the facilities [19] .

On September 28, 1945, the Special Committee decided to send a government commission to search for construction sites, and on October 26, these sites were approved in principle. After evaluating the final options, Plant No. 813 was placed on a mothballed aircraft plant site, and Plant No. 817 was placed on a new site chosen at the insistence of the facility's scientific director, Academician I. V. Kurchatov , since there were many similar-shaped bodies of water in the lake belt of the Southern Urals, which helped mislead enemy aerial reconnaissance [19] .

On November 30, 1945, the Special Committee made the final decision on the placement of the first two plants. It was confirmed on December 21 by Resolution of the Council of People's Commissars of the USSR No. 3150-952 ss [19] .

The volume of necessary construction work was very large, and the deadlines for the completion of the facilities were tight, so it was decided to involve experienced and qualified personnel of the Main Industrial Construction Directorate of the NKVD of the USSR in the construction: Chelyabmetallurgstroy in the Chelyabinsk Region , and Tagilstroy in the Sverdlovsk Region . Special NKVD construction departments No. 865 (Combine No. 813) and No. 1418 (Combine No. 817) were created for the construction of the plants .

Meanwhile, Academician L. A. Artsimovich conducted a series of successful experiments in Laboratory No. 2 of the USSR Academy of Sciences to obtain uranium-235 using magnetic separation. Member of the Technical Council under the Special Committee V. A. Makhnev reported this to L. P. Beria in September 1946 with a proposal to build a plant to produce uranium-235 using this method as well [19] .

On June 10, 1947, the issue of building Plant No. 814 was considered by the Special Committee. On June 19, L. P. Beria presented Stalin with a draft resolution of the USSR Council of Ministers on the establishment of a plant in the Isovsky District of the Sverdlovsk Region. On the same day, I. V. Stalin signed the corresponding resolution No. 2140-62 ss . The inventor of the method, Academician L. A. Artsimovich, was appointed scientific director of the plant. Since obtaining uranium isotopes in this technology required a powerful magnet that consumed a large amount of electricity, a new State District Power Plant was planned for its production - Nizhne-Turinskaya , with a capacity of 129 thousand kW, commissioned in 1949 [19] .

Construction of a gas diffusion plant in Novouralsk

In 1946, construction of a gas diffusion plant, called Combine No. 813 (Plant D-1) and intended for the production of highly enriched uranium, began at the production base of Plant No. 261 of the People's Commissariat of the Aviation Industry in Novouralsk . Professor I.K. Kikoin was appointed scientific director of the facility [19] .

The plant produced its first products in 1949. [20]

Construction of Chelyabinsk-40 (Plant No. 817)

For the construction of the first enterprise in the USSR for the production of plutonium for military purposes, a site was chosen in the Southern Urals, in the Chelyabinsk region in the area of the ancient Ural cities of Kyshtym and Kasli . Surveys for the selection of the site were conducted in the summer of 1945. On October 26, 1945, the Special Committee, in paragraph 1 of the protocol of meeting No. 7, recognized the expediency of placing the first industrial reactor on the southern shore of Lake Kyzyl-Tash, and the residential area on the peninsula on the southern shore of Lake Irtyash .

Over time, a whole complex of industrial enterprises, buildings and structures were erected on the site of the selected construction site, connected by a network of roads and railways, a heat and power supply system, industrial water supply and sewerage. At different times, the secret city was called by different names, but the most well-known name is Chelyabinsk-40 or "Sorokovka". Currently, the industrial complex, which was originally called Plant No. 817, is called the Mayak Production Association , and the city on the shore of Lake Irtyash, where Mayak employees and their families live, is called Ozersk .

In November 1945, geological surveys began at the selected site, and the first builders began to arrive at the beginning of December.

The first head of construction (1946-1947) was Ya. D. Rappoport , later he was replaced by Major General M. M. Tsarevsky . The chief engineer of construction was V. A. Saprykin, the first director of the future enterprise was P. T. Bystrov (from April 17, 1946), who was replaced by E. P. Slavsky (from July 10, 1947), and then B. G. Muzrukov (from December 1, 1947). I. V. Kurchatov was appointed scientific director of the plant [19] .

Construction of Arzamas-16

Since the end of 1945, a search for a place to house a secret facility, which would later be called KB-11 , began . Vannikov ordered a survey of Plant No. 550, located in the village of Sarov , and on April 1, 1946 , the village was chosen as the location of the first Soviet nuclear center, later known as Arzamas-16 . Yu. B. Khariton said that he personally flew around and inspected the sites proposed for the secret facility, and he liked the location of Sarov - a fairly deserted area, there is infrastructure (railway, production) and not very far from Moscow.

On April 9, 1946, the Council of Ministers of the USSR made important decisions concerning the organization of work on the USSR atomic project.

Resolution of the USSR CM No. 803-325ss "Questions of the First Main Directorate under the USSR CM" provided for a change in the structure of PSU and the unification of the Technical and Engineering-Technical Councils of the Special Committee into a single Scientific-Technical Council within PSU . B. L. Vannikov was appointed Chairman of the PSU Scientific and Technical Council, and I. V. Kurchatov and M. G. Pervukhin were appointed Deputy Chairmen of the Scientific and Technical Council. From December 1, 1949, I. V. Kurchatov became Chairman of the PSU Scientific and Technical Council.

By Resolution of the USSR Council of Ministers No. 805-327ss “Questions of Laboratory No. 2”, Sector No. 6 of this Laboratory was transformed into Design Bureau No. 11 at Laboratory No. 2 of the USSR Academy of Sciences for the development of the design and manufacture of prototypes of jet engines (the code name for atomic bombs).

The decree provided for the placement of KB-11 in the area of the village of Sarova on the border of the Gorky region and the Mordovian ASSR (now the city of Sarov in the Nizhny Novgorod region, previously known as Arzamas-16). P. M. Zernov was appointed head of KB-11 , and Yu. B. Khariton was appointed chief designer . The construction of KB-11 on the basis of Plant No. 550 in the village of Sarov was assigned to the People's Commissariat of Internal Affairs . A special construction organization was created to carry out all construction work - Construction Directorate No. 880 of the NKVD of the USSR . From April 1946, the entire personnel of Plant No. 550 were enrolled as workers and employees of Construction Directorate No. 880.

Construction of uranium hexafluoride production in Kirovo-Chepetsk

In 1946, in the workers' settlement of Kirovo-Chepetsky, at Plant 752 of the People's Commissariat of Chemical Industry of the USSR, the creation of industrial production of uranium hexafluoride , necessary for subsequent enrichment of uranium , began . The first industrial batch of the product was presented on December 19, 1949.

Scientific work

On April 30, 1946, a government decree was issued in which the Institute of Chemical Physics of the USSR Academy of Sciences was tasked with heading the theoretical and experimental research necessary for scientific support of the atomic project. The institute was to develop methods for measuring the parameters of physical processes accompanying an atomic explosion, create devices, and conduct measurements at the Semipalatinsk test site. A special closed sector was created at the institute, which at that time was just beginning its work in Moscow after the war, and M. A. Sadovsky was appointed its head [21] .

Products

Development of the design of atomic bombs

By the Resolution of the Council of Ministers of the USSR No. 1286-525ss "On the plan for the development of the work of KB-11 at Laboratory No. 2 of the USSR Academy of Sciences" the first tasks of KB-11 were defined: the creation, under the scientific supervision of Laboratory No. 2 (Academician I. V. Kurchatov), of atomic bombs, conditionally called in the resolution "jet engines S", in two versions: RDS-1 - an implosion type with plutonium and the RDS-2 gun-type atomic bomb with uranium-235 .

The tactical and technical specifications for the RDS-1 and RDS-2 designs were to be developed by July 1, 1946, and the designs of their main units by July 1, 1947. The fully manufactured RDS-1 bomb was to be submitted for state tests for detonation when installed on the ground by January 1, 1948, in the aviation version by March 1, 1948, and the RDS-2 bomb by June 1, 1948 and January 1, 1949, respectively. Work on creating the designs was to be carried out in parallel with the organization of special laboratories in KB-11 and the deployment of these laboratories. Such tight deadlines and the organization of parallel work also became possible thanks to the receipt by the USSR of the most detailed intelligence data on American atomic bombs, including drawings of individual units and a description of the technology for their manufacture. The RDS-1 was structurally an exact copy of the American model, with some improvements.

Research laboratories and design departments of KB-11 began to develop their activities directly in Arzamas-16 in the spring of 1947. In parallel, the first production workshops of pilot plants No. 1 and No. 2 were created.

Nuclear reactors

The first experimental nuclear reactor in the USSR , F-1 , which was built in Laboratory No. 2 of the USSR Academy of Sciences, was successfully launched on December 25, 1946.

On November 6, 1947, the Minister of Foreign Affairs of the USSR V. M. Molotov made a statement regarding the secret of the atomic bomb, saying that "this secret has long since ceased to exist." This statement meant that the Soviet Union had already discovered the secret of atomic weapons, and it had these weapons at its disposal. The scientific circles of the USA regarded this statement by V. M. Molotov as a bluff, believing that the Russians could not master atomic weapons before 1952.

In less than two years, the building of the first nuclear industrial reactor "A" of Plant No. 817 was ready, and work began on assembling the reactor itself. The physical start-up of reactor "A" took place at 00:30 on June 18, 1948, and on June 19 the reactor was brought to its design capacity.

On December 22, 1948, the first products from the nuclear reactor arrived at the radiochemical plant "B". At the plant "B" the plutonium produced in the reactor was separated from uranium and radioactive fission products. All radiochemical processes for the plant "B" were developed at the Radium Institute under the supervision of Academician V. G. Khlopin. The general designer and

chief engineer of the plant "B" project was A. Z. Rothschild , and the chief technologist was Ya. I. Zilberman . The scientific director of the launch of the plant "B" was Corresponding Member of the USSR Academy of Sciences B. A. Nikitin .

The first batch of finished products (plutonium concentrate, consisting mainly of plutonium and lanthanum fluorides) was received in the refining department of Plant B in February 1949.

Obtaining weapons-grade plutonium

The plutonium concentrate was transferred to Plant “B”, which was intended to produce high-purity metallic plutonium and products made from it.

The main contribution to the development of technology and design of plant “B” was made by: A. A. Bochvar , I. I. Chernyaev , A. S. Zaimovsky , A. N. Volsky , A. D. Gelman , V. D. Nikolsky, N. P. Aleksakhin, P. Ya. Belyaev, L. R. Dulin, A. L. Tarakanov and others.

In August 1949, Plant V produced components from high-purity metallic plutonium for the first atomic bomb.

Tests

The successful test of the first Soviet atomic bomb RDS-1 was conducted on August 29, 1949, at exactly 7:00 am at a constructed test site in the Semipalatinsk region of Kazakhstan [13] . It was kept secret.

On September 3, 1949, a US Special Weather Reconnaissance aircraft took air samples in the Kamchatka region , and American specialists then found isotopes in them that indicated that a nuclear explosion had been carried out in the USSR. US President Harry Truman publicly announced this on September 23, but his statement was somewhat vague: “We have evidence that an atomic explosion has occurred in the Soviet Union in recent weeks. Ever since atomic energy was released by man, the eventual development of this new force by other nations has been expected. This possibility has always been taken into account. Almost four years ago I pointed out that scientists were virtually unanimous in believing that the essential theoretical information on which the discovery was based was already widely known...” [22] .

This was followed by the following statement from TASS :

> On September 23, President Truman announced that, according to the US government, an atomic explosion had occurred in the last few weeks. At the same time, a similar statement was made by the British and Canadian governments, and following the publication of these statements, numerous statements appeared in the American, British and Canadian press, as well as in the press of other countries, sowing alarm in broad public circles. In connection with this, TASS is authorized to state the following.
>
> In the Soviet Union, as is well known, large-scale construction work is being carried out - the construction of hydroelectric power stations, mines, canals, roads, which necessitate large-scale blasting operations using the latest technical means. Since these blasting operations have occurred and are occurring quite frequently in

> different parts of the country, it is possible that this could have attracted attention outside the Soviet Union. As for the production of atomic energy, TASS considers it necessary to recall that on November 6, 1947, the Minister of Foreign Affairs of the USSR V. M. Molotov made a statement regarding the secret of the atomic bomb, saying that "this secret has long since ceased to exist."

On March 8, 1950, Deputy Chairman of the Council of Ministers of the USSR Klim Voroshilov officially announced the presence of an atomic bomb in the USSR [23] .

Ratings

- Interviewer (2009): “Almost half a century later, the main prosecution witness for the Rosenberg couple suddenly repented, saying that he had slandered Ethel Rosenberg. Does that mean we didn’t steal the secret of creating nuclear weapons from the US?” Sergey Kapitsa : “The USSR itself created the atomic bomb. Beria’s information only helped him convince Stalin to start working on nuclear weapons. Enormous amounts of money were needed. Roosevelt invested two billion dollars in the nuclear project! More than in the automobile industry. Something else is more interesting. The first to understand the reality of this matter were the physicists who fled from Germany to England to escape Hitler. But the British did not have enough material resources and they offered the Americans to create the nuclear bomb. They agreed, but immediately classified all information on the project. And at that time, the US-England-USSR agreement on the exchange of scientific and technical information was in effect. " They gave us data on America's second most important military project in the field of radar, but they kept silent about the work on the atomic bomb. This gave us the full moral right to spy on the allies" [24] . Kapitsa also noted about the role of intelligence: "The main thing is that they explained to the authorities what was happening in America, and they also gave us the most important secret of the atomic bomb, thanks to which it could be made" [25] .

In art

- novel "The Last Case of Lavrentiy Beria" (author - Sigismund Mironin)
- feature film " Choice of Target " (USSR, 1974)
- TV series " Bomb " (2013 , Ukraine-Russia) [26]
- TV series " Bomb " (Russia, 2020)
- TV series "Atom" (Russia, 2025)

See also

- When will Russia have an atomic bomb?
- The creation of the Soviet hydrogen bomb
- Nuclear race
- Nuclear parity

Notes

1. *Oleg Troyanovsky* . "Through the years and distances". - M .: " Tsentrpoligraf ", 2017. - ISBN 978-5-227-06637-4 .

2. V. G. Khlopin Radium Institute. Chronology. (https://web.archive.org/web/20120319095456/http://www.khlopin.ru/hronology.php) Date accessed: 28 March 2010. Archived fromthe original (http://www.khlopin.ru/hronology.php)on 19 March 2012. (http://www.khlopin.ru/hronology.php)
3. *Astashenkov, P. T.* . Kurchatov . - 2nd ed. - M .: Molodaya Gvardiya , 1968. - 198 p. - (The Lives of Remarkable People : A Series of Biographies; Issue 462). - 100,000 copies.
4. *Gubarev Vladimir.* White Archipelago (http://www.nkj.ru/archive/articles/6793/) //Science and Life : Magazine. -M., 2000. -Issue 3.ArchivedNovember (https://web.archive.org/web/20101125035408/http://www.nkj.ru/archive/articles/6793/)25, 2010. (https://web.archive.org/web/20101125035408/http://www.nkj.ru/archive/articles/6793/)
5. *Martsinkevich, Boris Leonidovich* . "Stone Age Technologies". Why the West Shifted and Conceded. (https://www.youtube.com/watch?v=IADxKLl8wso) *Geoenergetics*. TV Day (November 9, 2020). Accessed November 16, 2020.Archived (https://web.archive.org/web/20210108093254/https://www.youtube.com/watch?v=IADxKLl8wso)January 8, 2021. (https://web.archive.org/web/20210108093254/https://www.youtube.com/watch?v=IADxKLl8wso)
6. *Lyudmila Romanenko, Ekaterina Kitaytseva.* Pavel Fitin vs. Schellenberg (https://russia.tv/brand/show/brand_id/59331) . *Without Witnesses* . Russia-1 (2015). Accessed November 16, 2020. Archived (https://web.archive.org/web/20200820202313/https://russia.tv/brand/show/brand_id/59331) August 20, 2020. (https://web.archive.org/web/20200820202313/https://russia.tv/brand/show/brand_id/59331)
7. *Bondarenko, A.Yu.* . The Return of General Fitin (https://regnum.ru/news/society/2332491.html) . *regnum.ru* . IA Regnum (October 10, 2017). Date of access: November 15, 2020. Archived (https://web.archive.org/web/20201117023320/https://regnum.ru/news/society/2332491.html) November 17, 2020. (https://web.archive.org/web/20201117023320/https://regnum.ru/news/society/2332491.html)
8. Atomic Themes in the Activities of Soviet Intelligence in 1941-1950 (https://cyberleninka.ru/article/n/atomnaya-tematika-v-deyatelnosti-sovetskoy-razvedki-v-1941-1950-gg) . Accessed: January 15, 2024.Archived (https://web.archive.org/web/20240115145424/https://cyberleninka.ru/article/n/atomnaya-tematika-v-deyatelnosti-sovetskoy-razvedki-v-1941-1950-gg)January 15, 2024. (https://web.archive.org/web/20240115145424/https://cyberleninka.ru/article/n/atomnaya-tematika-v-deyatelnosti-sovetskoy-razvedki-v-1941-1950-gg)
9. «PROBLEM #1». Part III. The contribution of intelligence officers to the Soviet atomic project. The initial period 1941-1945. (http://shieldandsword.mozohin.ru/library/problem1_3.htm) Date of access: 3 August 2021. Archived from (https://web.archive.org/web/20210803170708/http://shieldandsword.mozohin.ru/library/problem1_3.htm) the original on 3 August 2021. (https://web.archive.org/web/20210803170708/http://shieldandsword.mozohin.ru/library/problem1_3.htm)
10. Thomas B. Cochran, Robert S. Norris, Oleg A. Bukharin, MAKING THE RUSSIAN BOMB FROM STALIN TO YELTSIN (https://web.archive.org/web/20101214091141/http://docs.nrdc.org/nuclear/files/nuc_01019501a_138.pdf) , Natural Resources Defense Council, Inc., Westview Press Boulder, San Francisco, Oxford, 1995.
11. Goncharov G. A., Ryabev L. D. On the creation of the first domestic atomic bomb. // Uspekhi fizicheskikh nauk. Vol. 171, No. 1, P. 79-104
12. Order No. 122 of the USSR Academy of Sciences dated March 10, 1943 “Appoint Professor I. V. Kurchatov as head of Laboratory No. 2. *Vice-President of the USSR Academy of Sciences Academician A. A. Baikov. Secretary of the Presidium of the USSR Academy of Sciences Academician N. G. Bruevich* ”
13. *Roy Medvedev , Zhores Medvedev* . "Stalin and the Atomic Bomb" (https://web.archive.org/web/20110519192103/http://www.rg.ru/Anons/arc_1999/1221/22.htm) . *Rossiyskaya Gazeta* (December 21, 1999). Retrieved November 16, 2020. Archived fromthe original (https://rg.ru/Anons/arc_1999/1221/22.htm)on May 19, 2011. (https://rg.ru/Anons/arc_1999/1221/22.htm)
14. Vladimir Gubarev. "Urgently Needed Uranium" (http://www.inauka.ru/catalogue/article31986) Archived (https://web.archive.org/web/20080921071308/http://www.inauka.ru/catalogue/article31986) September 21, 2008, at the Wayback Machine // Izvestia Nauki, August 24, 2001
15. Nikitchuk I. I. "Stalin and the Soviet Atomic Project" (http://www.dya.ru/museum/mr8_01.phtml) Archived (https://web.archive.org/web/20071218224457/http://www.dya.ru/museum/mr8_01.phtml) December 18, 2007, at the Wayback Machine // Children's Nuclear Academy

16. Kharkiv Institute of Physics and Technology: from RDS-1 to the Hadron Collider (https://www.webcitation.org/65rOLA9if?url=http://odnarodyna.com.ua/articles/5/814.html?print) . Internet project "One Homeland" (August 29, 2009). Retrieved March 17, 2010. Archived from the original (http://www.odnarodyna.ru/articles/5/814.html?print) on March 2, 2012. (http://www.odnarodyna.ru/articles/5/814.html?print)
17. *Soyfer, Valery Nikolaevich.* Yuli Khariton: We Made the Hydrogen Bomb Before the Americans (http://www.sib-science.info/ru/news/vodorodnuyu-bombu-07112017) .*News of Siberian Science*. Scientific and Technical Library of the Siberian Branch of the Russian Academy of Sciences (November 8, 2017). Accessed November 8, 2020.Archived (https://web.archive.org/web/20240316024143/https://www.sib-science.info/)March 16, 2024. (https://web.archive.org/web/20240316024143/https://www.sib-science.info/)
18. Professor Fritz Strassmann: "In Search of the Elusive" (https://www.pravda.ru/science/1649303-fric_shtrassman/) Archived (https://web.archive.org/web/20220108071122/https://www.pravda.ru/science/1649303-fric_shtrassman/) 8 January 2022 at the Wayback Machine // Pravda.ru , 15.10.2021
19. *Kuznetsov, Viktor Nikolaevich* .History of the atomic project in the Urals (http://elib.biblioatom.ru/text/kuznetsov_istoria-atomnogo-proekta-na-urale_2009/go,2/)/Speransky, Andrey Vladimirovich. - Essays and articles. - Ekaterinburg: Autograph, 2009 . - Pp. 5-15, 22-40. - 294 p. -ISBN 978-5-98955-050-0. Archived (https://web.archive.org/web/20210524111457/http://elib.biblioatom.ru/text/kuznetsov_istoria-atomnogo-proekta-na-urale_2009/go,2/) May 24, 2021. (http://elib.biblioatom.ru/text/kuznetsov_istoria-atomnogo-proekta-na-urale_2009/go,2/) (https://web.archive.org/web/20210524111457/http://elib.biblioatom.ru/text/kuznetsov_istoria-atomnogo-proekta-na-urale_2009/go,2/)
20. Open Joint Stock Company "Ural Electrochemical Plant" > About the enterprise > History (https://web.archive.org/web/20131202222351/http://www.ueip.ru/about/Pages/HistoryUEIP.aspx) . Retrieved on August 31, 2013. Archived from the original (http://www.ueip.ru/about/Pages/HistoryUEIP.aspx) on December 2, 2013. (http://www.ueip.ru/about/Pages/HistoryUEIP.aspx)
21. RFBR Portal (http://www.rfbr.ru/rffi/ru/books/o_66348#217) . Accessed: June 13, 2016. Archived (https://web.archive.org/web/20160924070237/http://www.rfbr.ru/rffi/ru/books/o_66348#217) September 24, 2016. (https://web.archive.org/web/20160924070237/http://www.rfbr.ru/rffi/ru/books/o_66348#217)
22. 1949: American Response to Soviet Atomic Explosion (http://www.svoboda.org/content/transcript/1810952.html) . Retrieved 31 August 2013. Archived from (https://web.archive.org/web/20130622160120/http://www.svoboda.org/content/transcript/1810952.html) the original on 22 June 2013. (https://web.archive.org/web/20130622160120/http://www.svoboda.org/content/transcript/1810952.html)
23. 70 years ago, Moscow announced the presence of its own nuclear weapons (https://rg.ru/2020/03/08/70-let-nazad-moskva-obiavila-o-nalichii-sobstvennogo-iadernogo-oruzhiia.html) . Retrieved 7 February 2023. Archived (https://web.archive.org/web/20210830045313/https://rg.ru/2020/03/08/70-let-nazad-moskva-obiavila-o-nalichii-sobstvennogo-iadernogo-oruzhiia.html) 30 August 2021. (https://web.archive.org/web/20210830045313/https://rg.ru/2020/03/08/70-let-nazad-moskva-obiavila-o-nalichii-sobstvennogo-iadernogo-oruzhiia.html)
24. Sergey Kapitsa: "I'm like a white crow!" - July 13, 2009 - Fontanka.Ru (https://www.fontanka.ru/2009/07/13/078/) . Date of access: September 26, 2023. Archived (https://web.archive.org/web/20230926170926/https://www.fontanka.ru/2009/07/13/078/) September 26, 2023. (https://web.archive.org/web/20230926170926/https://www.fontanka.ru/2009/07/13/078/)
25. “Gordon Boulevard”, No. 19 (263) 2010, May / Boulevard (https://www.bulvar.com.ua/gazeta/archive/s19_63859/6147.html)
26. «Bomb» (TV series) (https://afisha.mail.ru/series_805197_bomba/) . Retrieved April 15, 2015. Archived (https://web.archive.org/web/20151023143732/https://afisha.mail.ru/series_805197_bomba/) October 23, 2015. (https://web.archive.org/web/20151023143732/https://afisha.mail.ru/series_805197_bomba/)

Literature

- The USSR Atomic Project: Documents and Materials / Ministry of Atomic Energy of the Russian Federation, Russian Academy of Sciences; [Comp.: L. I. Kudinova (responsible compiler) and others]; Under the general editorship of L. D. Ryabev . — Moscow: Science : Fizmatlit , 1998–2010.:
  - T. 1, part 1: 1938-1945. - 1998. - 431 pp.; ISBN 5-02-015008-8
  - T. 1, part 2: 1938-1945. - 2002. - 797 p.; ISBN 5-89155-095-4
  - V. 2, book 1: The Atomic Bomb, 1945-1954 / [Comp.: G. A. Goncharov (responsible compiler, and others]. — 1999. — 718 p.; ISBN 5-85165-402-3
  - V. 2, book 2: The Atomic Bomb, 1945-1954 / [Comp.: G. A. Goncharov (responsible compiler) and others]. — 2000. — 635 p.; ISBN 5-85165-402-3
  - V. 2, v. 3: The Atomic Bomb, 1945-1954 / [Comp.: G. A. Goncharov (responsible compiler), P. P. Maksimenko]. — 2002. — 893 p.; ISBN 5-85165-402-3
  - V. 2, v. 4: The Atomic Bomb, 1945-1954 / [Comp.: G. A. Goncharov (responsible compiler), P. P. Maksimenko]. — 2003. — 812 p.; ISBN 5-85165-402-3
  - V. 2, v. 5: The Atomic Bomb, 1945-1954 / [compiled by: G. A. Goncharov (responsible compiler), P. P. Maksimenko]. — 2005. — 972 p.; ISBN 5-85165-402-3
  - V. 2, v. 6: The Atomic Bomb, 1945-1954 / [compiled by: G. A. Goncharov (responsible compiler), P. P. Maksimenko]. — 2006. — 892 p.; ISBN 5-85165-402-3
  - V. 2, v. 7: The Atomic Bomb, 1945-1954 / [compiled by: G. A. Goncharov (responsible compiler), P. P. Maksimenko]. — 2007. — 693 p.; ISBN 978-5-9221-0855-3
  - T. 3, book. 1: Hydrogen bomb. 1945-1956. - 2008. - 734 pp.; ISBN 978-5-9221-1026-6
  - V. 3, v. 2: Hydrogen Bomb. 1945-1956 / Under the general editorship of L. D. Ryabev; compiled by: G. A. Goncharov (responsible compiler), P. P. Maksimenko. — 2009. — 596 p.; ISBN 978-5-9221-1157-7
  - Reference volume: Atomic Bomb, 1945-1954. Hydrogen Bomb, 1945-1956. / [compiled by: P. P. Maksimenko (responsible compiler)]. — 2010. — 709 p.; ISBN 978-5-9221-1284-0
- *I. A, Andryushin A. K. Chernyshev Yu. A. Yudin.* Taming the Core. Pages of the History of Nuclear Weapons and Nuclear Infrastructure of the USSR (http://npc.sarov.ru/issues/coretaming/coretaming.pdf) . - Sarov: Krasny Oktyabr, 2003. - 481 p. - ISBN 5-7439-0621-6 . Archived (https://web.archive.org/web/20070710074913/http://npc.sarov.ru/issues/coretaming/coretaming.pdf) July 10, 2007, at the Wayback Machine
- *R. Jung.* Brighter than a Thousand Suns. - M. , 1961.
- The Soviet atomic project: the end of the atomic monopoly. How it was... — Nizhny Novgorod, Arzamas-1, 1995. — ISBN 978-5-9515-0212-4 . — 214 p.
- *Rodin A. M.* L. P. Beria in the atomic project. (http://history.milportal.ru/l-p-beriya-v-atomnom-proekte/) // Military-historical magazine . - 2012. - No. 9. - P.60-66.

Links

- Chronology of the main events in the history of the nuclear industry of the USSR and Russia (https://web.archive.org/web/20101001114941/http://www.npc.sarov.ru/issues/coretaming/chronology1.html)
- On the creation of the first domestic atomic bomb (https://web.archive.org/web/20100223063903/http://wsyachina.narod.ru/history/rds_1.html)
- Vladimir Gubarev "White Archipelago. Unknown Pages of the "USSR Atomic Project"" (https://web.archive.org/web/20100727104618/http://wsyachina.narod.ru/history/white_archipelago_1.html)
- Taming the Core (https://web.archive.org/web/20110722142453/http://poligon.kz/doc/coretaming.pdf)
- Sergei Leskov "Bomb from the German Baron" (https://archive.today/20120804013738/www.izvestia.ru/hystory/article3132333/)

- Vladimir Vasiliev "Abkhazia is a forge of nuclear weapons. Over half a century ago, German nuclear experts were secretly brought to Sukhumi (http://nuclearno.ru/text.asp?10031)
- A. Bedel. Our Answer to Truman (https://archive.today/20130103184250/www.istrodina.com/rodina_articul.php3?id=250&n=14)
- Norilsk in the solution of the atomic issue or the fate of Norilsk "macaroni" (https://web.archive.org/web/20121124043010/http://2002.vernadsky.info/raboty/h1/w0217.htm)
- Radio Liberty's broadcast "1949: American reaction to Soviet atomic explosion" (http://www.svobodanews.ru/content/transcript/1810952.html?page=2)
- The USSR Atomic Project. On the 60th Anniversary of the Creation of Russia's Nuclear Shield. July 24 – September 20 (http://www.rusarchives.ru/evants/exhibitions/atom-kat.shtml) , *2009. Exhibition Description* . Ministry of Culture of the Russian Federation , Federal Archival Agency , State Atomic Energy Corporation Rosatom , State Archives of the Russian Federation (2009). Accessed: October 23, 2011.
- R.D.S. Chronicle of the First Test. (https://www.youtube.com/watch?v=l1UQX--6Yio) Documentary about the development and testing of the USSR atomic bomb

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